

Overview of Harvested Wood Products Assessment for WA

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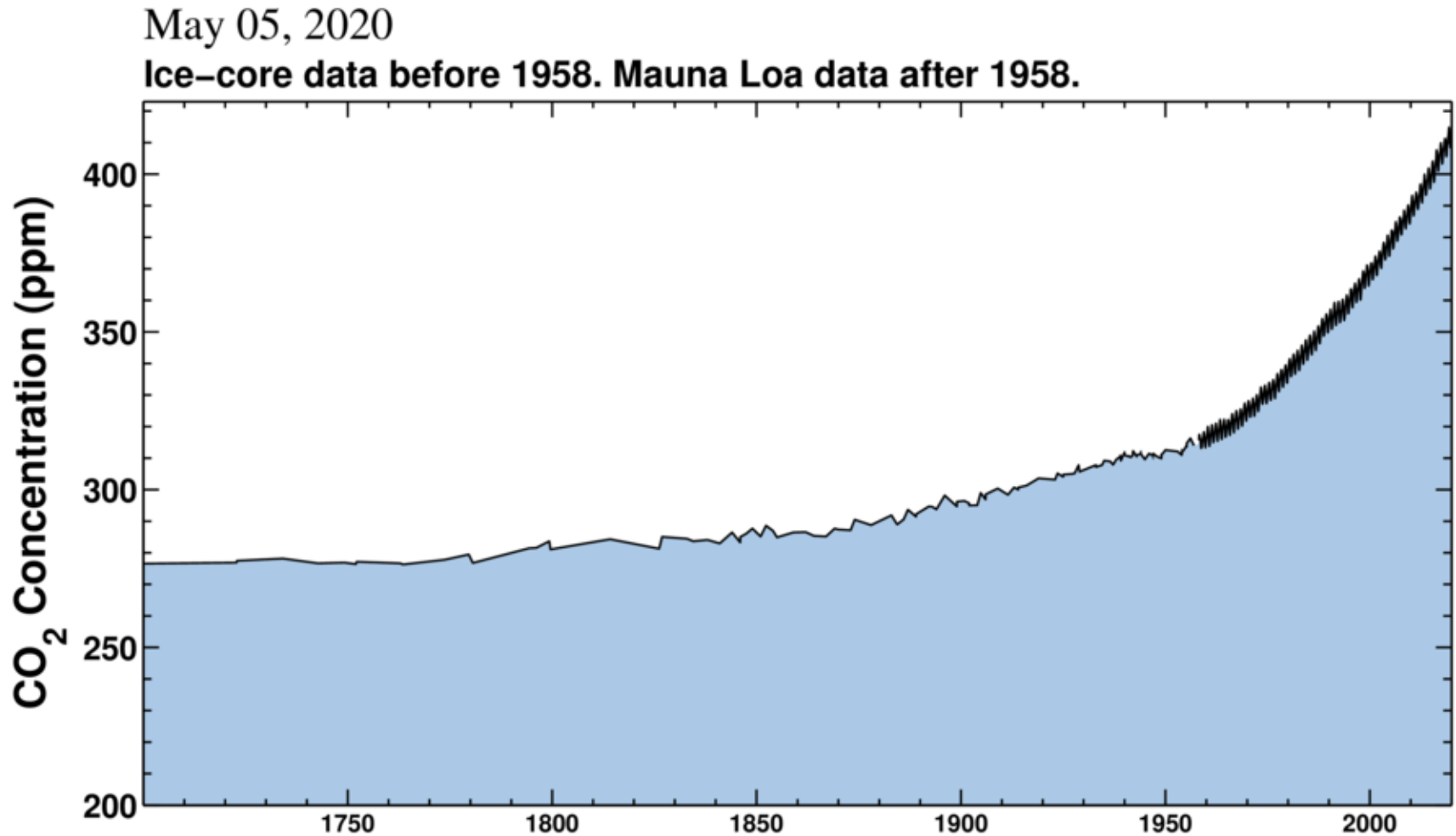
Photo credit: PNW FIA Crew



WA CSAG Meeting – May 8, 2020



Why is this important?



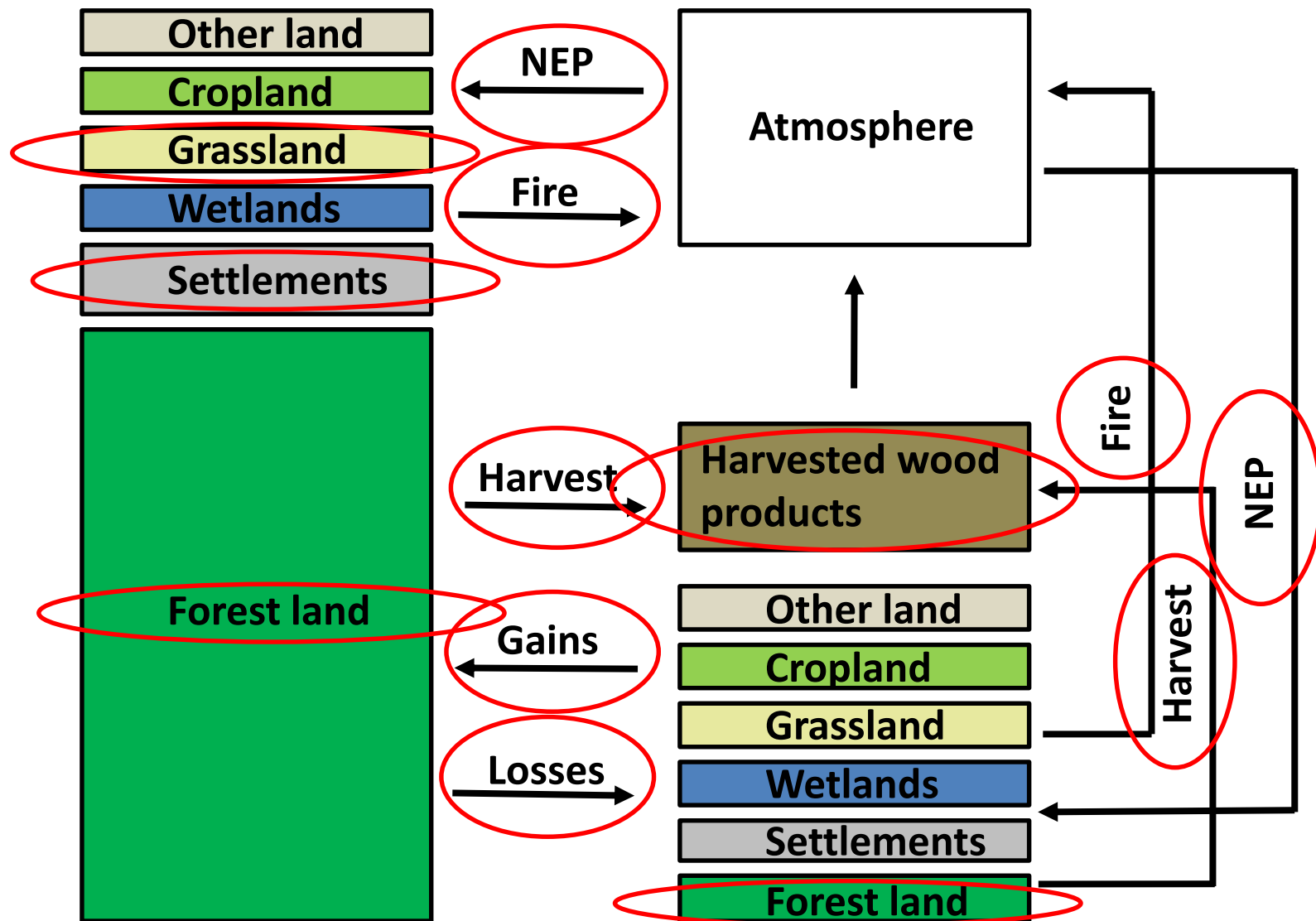
Mission...



...which will help land managers and policy makers evaluate existing practices and policies and inform future activities



Context within the land sector



2020 NIR: (752.9)MMT CO₂ eq. (11%)

C stocks by pool in the US

Carbon Pool ^a	1990	1995	2000	2005	2010	2017	2018	2019
Forest	51,527	52,358	53,161	53,886	54,663	55,746	55,897	56,051
Aboveground biomass	11,833	12,408	12,962	13,484	14,020	14,780	14,884	14,989
Belowground biomass	2,350	2,483	2,612	2,734	2,858	3,033	3,056	3,081
Dead wood	2,120	2,233	2,346	2,454	2,568	2,731	2,753	2,777
Litter	3,662	3,670	3,676	3,647	3,646	3,639	3,640	3,641
Soil (mineral)	25,636	25,636	25,637	25,639	25,641	25,637	25,637	25,638
Soil (organic)	5,927	5,928	5,928	5,929	5,929	5,926	5,926	5,926
Harvested wood	1,895	2,061	2,218	2,353	2,462	2,616	2,642	2,669
Products in use	1,249	1,326	1,395	1,447	1,471	1,505	1,513	1,521
SWDS	646	735	823	906	991	1,112	1,129	1,148
Total stocks	53,423	54,419	55,380	56,239	57,124	58,362	58,539	58,720

Domke, Grant M.; Walters, Brian F.; Nowak, David J.; Smith, James, E.; Ogle, Stephen M.; Coulston, J.W.; Wirth, T.C. 2020. Greenhouse gas emissions and removals from forest land, woodlands, and urban trees in the United States, 1990-2018. Resource Update FS-227. Madison, WI: U.S. Department of Agriculture, Forest Service, Northern Research Station. 5 p. <https://doi.org/10.2737/FS-RU-227>.

U.S. Environmental Protection Agency [US EPA]. 2020. Inventory of U.S. greenhouse gas emissions and sinks: 1990-2018. EPA 430-R-20-002. Washington, DC: U.S. Environmental Protection Agency. <https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks-1990-2018>

C fluxes by pool in the US

Carbon Pool ^a	1990	1995	2000	2005	2010	2016	2017	2018
Forest ecosystem	(610.1)	(598.7)	(572.1)	(572.6)	(556.2)	(565.5)	(552.0)	(564.5)
Aboveground biomass	(425.1)	(416.1)	(392.7)	(391.3)	(391.3)	(397.0)	(381.2)	(385.2)
Belowground biomass	(98.6)	(96.6)	(91.5)	(90.8)	(90.3)	(91.1)	(87.6)	(88.6)
Dead wood	(81.9)	(82.8)	(82.7)	(84.1)	(83.4)	(87.6)	(83.1)	(86.4)
Litter	(5.0)	(3.5)	(4.5)	(5.2)	(1.4)	(0.9)	(3.5)	(3.1)
Soil (mineral)	0.3	(0.1)	(1.0)	(1.8)	4.6	8.2	1.4	(3.3)
Soil (organic)	(0.6)	(0.5)	(0.3)	(0.1)	4.9	2.3	1.4	1.4
Drained organic soil	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Harvested wood	(123.8)	(112.2)	(93.4)	(106.0)	(69.1)	(92.4)	(95.7)	(98.8)
Products in use	(54.8)	(51.7)	(31.9)	(42.6)	(7.4)	(27.8)	(30.3)	(31.5)
SWDS	(69.0)	(60.5)	(61.5)	(63.4)	(61.7)	(64.6)	(65.5)	(67.2)
Total Net Flux	(733.9)	(710.9)	(665.5)	(678.6)	(625.3)	(657.9)	(647.7)	(663.2)

Domke, Grant M.; Walters, Brian F.; Nowak, David J.; Smith, James, E.; Ogle, Stephen M.; Coulston, J.W.; Wirth, T.C. 2020. Greenhouse gas emissions and removals from forest land, woodlands, and urban trees in the United States, 1990-2018. Resource Update FS-227. Madison, WI: U.S. Department of Agriculture, Forest Service, Northern Research Station. 5 p. <https://doi.org/10.2737/FS-RU-227>.

U.S. Environmental Protection Agency [US EPA]. 2020. Inventory of U.S. greenhouse gas emissions and sinks: 1990-2018. EPA 430-R-20-002. Washington, DC: U.S. Environmental Protection Agency. <https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks-1990-2018>

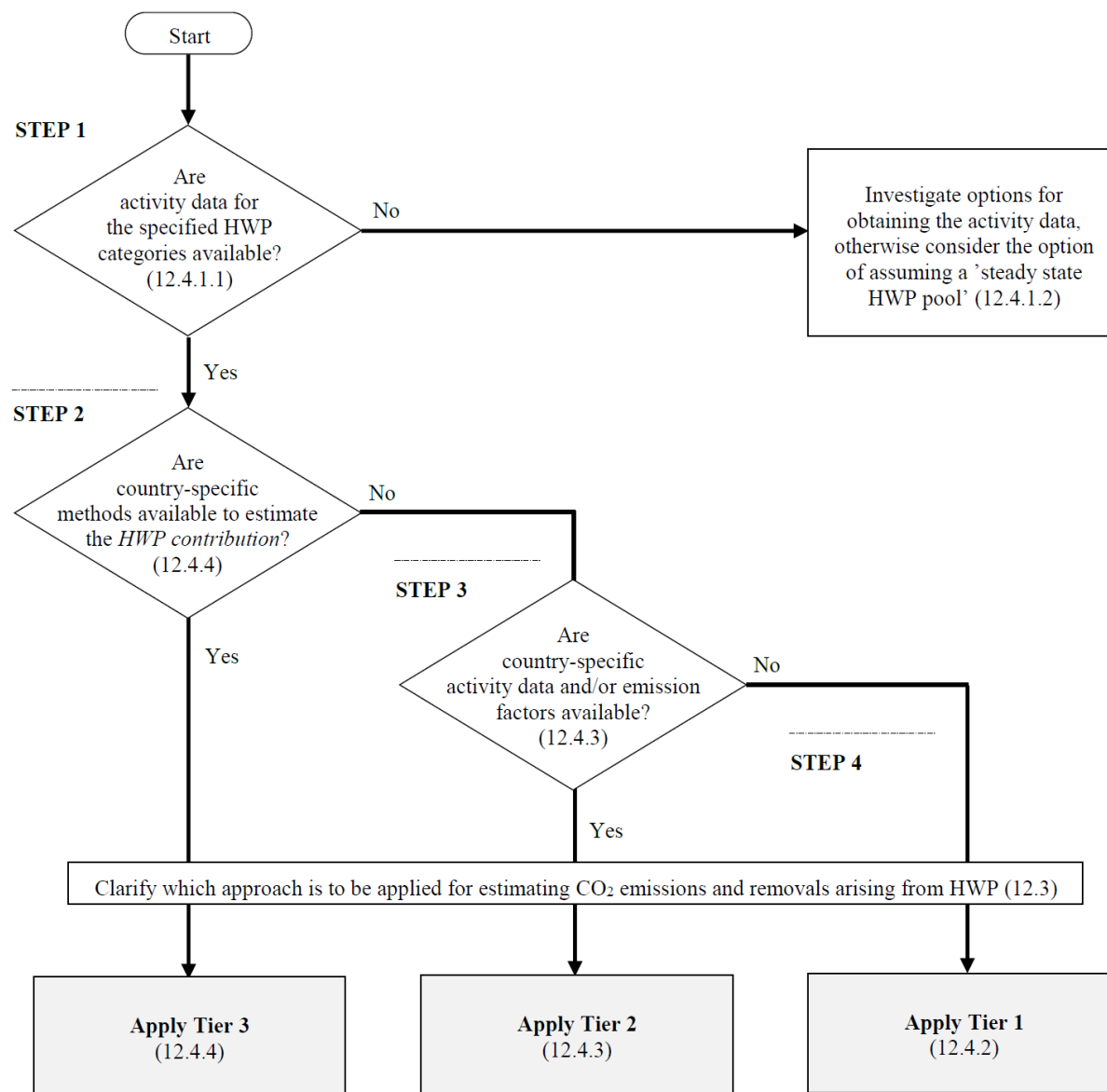
Motivation

“...inventories should contain neither over nor underestimates so far as can be judged, and the uncertainties in these estimates should be reduced as far as practicable.” – IPCC



- Expand the use of in situ plots
- Integrate auxiliary information
- Align national and international reporting instruments
- Maintain transparency and open access
- Incorporate emerging science
- Build partnerships
- Remain nimble to address ever-changing requests, guidance, and stakeholder needs

Where do we start?



IPCC Tiers

- Tier 1: Coarse assumptions, UN-FAO data
- Tier 2: Coarse assumptions, area specific data
- Tier 3: Complex, detailed, area specific methods
 - Single approach
 - More complex decay functions
 - Detailed tracking over many years
 - Account for exported products
 - Potential information from outside the area
 - Interaction with other sectors (waste, energy, etc.)

IPCC Methods

1. Stock change methods

- All HWP consumed in the area, regardless of origin
- Imports are included, exports are excluded

2. Production methods

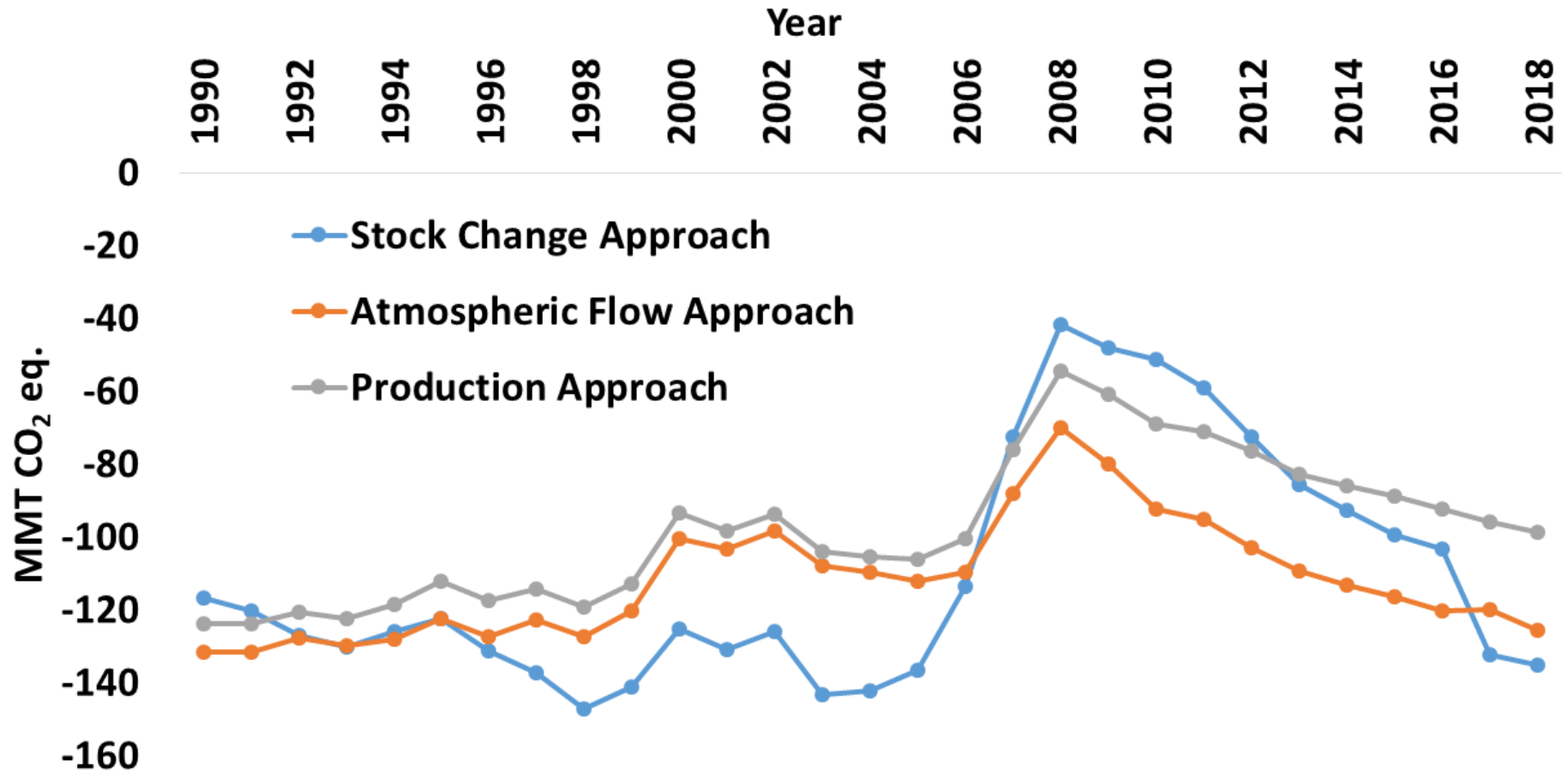
- All HWP produced from timber harvested in the area
- Exports are included, imports are excluded

3. Atmospheric flow methods

- Direct estimation of annual atmospheric flux within domain boundaries

4. Combined methods

Comparison of approaches



Biomass for energy

TABLE 12.5

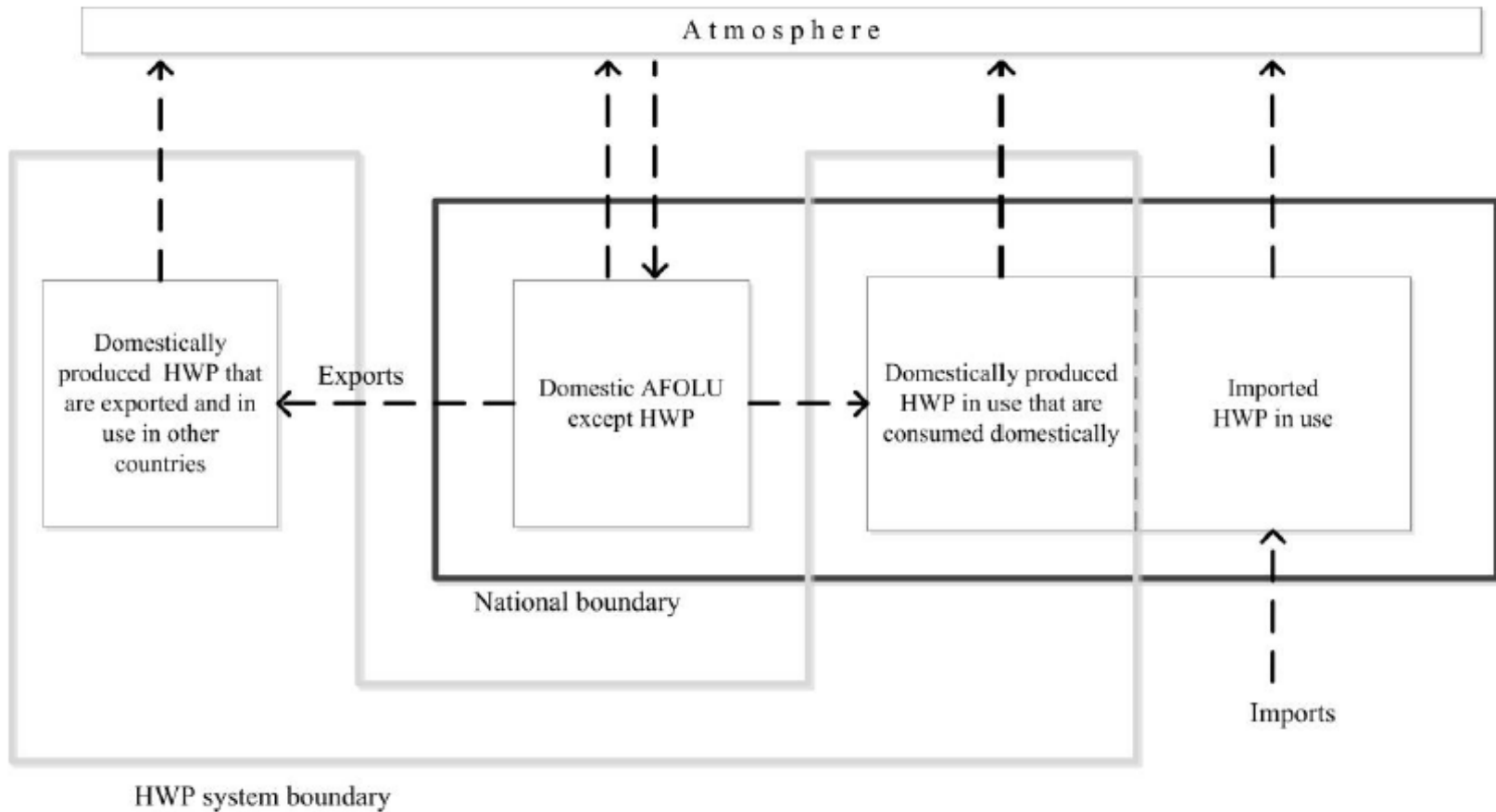
REPORTING OF CO₂ EMISSIONS FROM WOOD BIOMASS BURNT BY PRODUCING AND CONSUMING COUNTRIES UNDER DIFFERENT HWP APPROACHES

Element of wood biomass	Assumption of ‘a steady-state HWP pool’	‘Stock-change’ approach	‘Production’ approach*	‘Atmospheric-flow’ approach
Unutilized wood harvest residues	Producing country	Producing country	Producing country	Producing country
Harvested wood biomass used directly as energy feedstocks				Consuming country
Industrial residues from manufacturing semi-finished wood products				
Industrial residues from manufacturing finished wood products in use**				
Wood biomass collected and burnt as post-consumer waste				

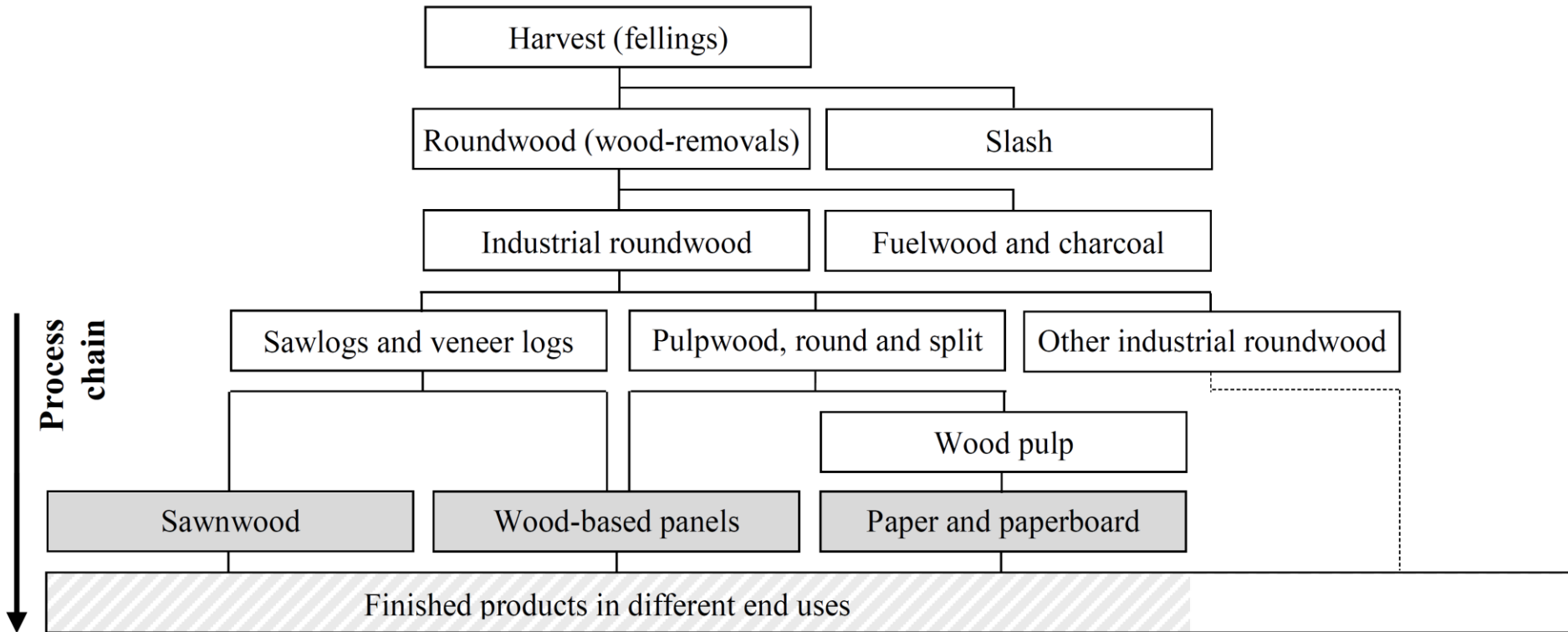
* Discussion of the 'production' approach in this section also applies for the 'simple-decay' approach (see Section 12.3 and Annex 12.A)

** In the case of the 'stock-change' approach, strictly, CO₂ emissions from wood biomass collected and burnt as post-consumer waste are only reported by a consuming country if the finished wood products are consumed and used in the country where they are manufactured and are not exported to another country.

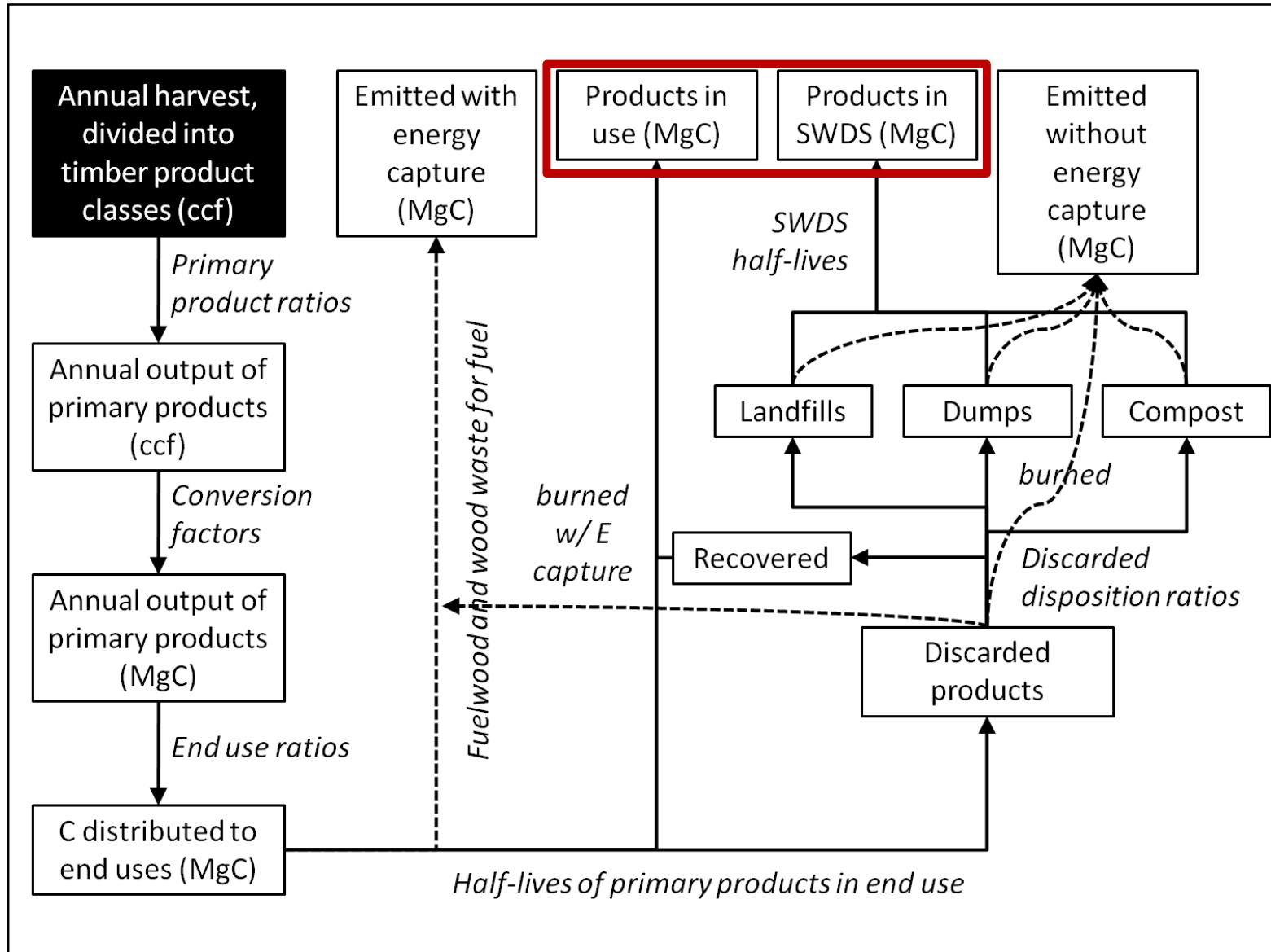
Production Approach



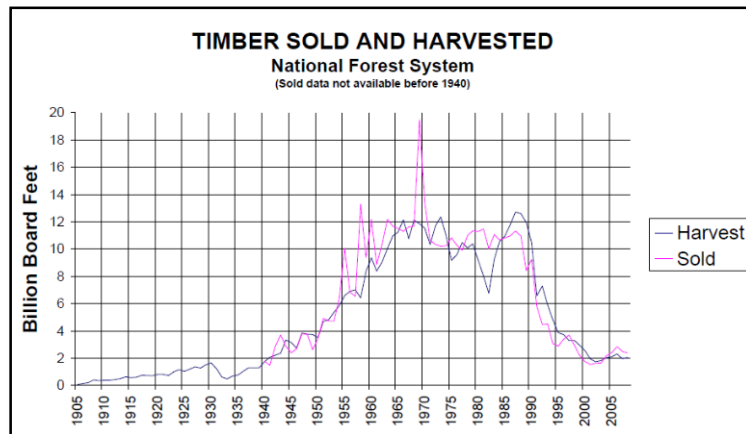
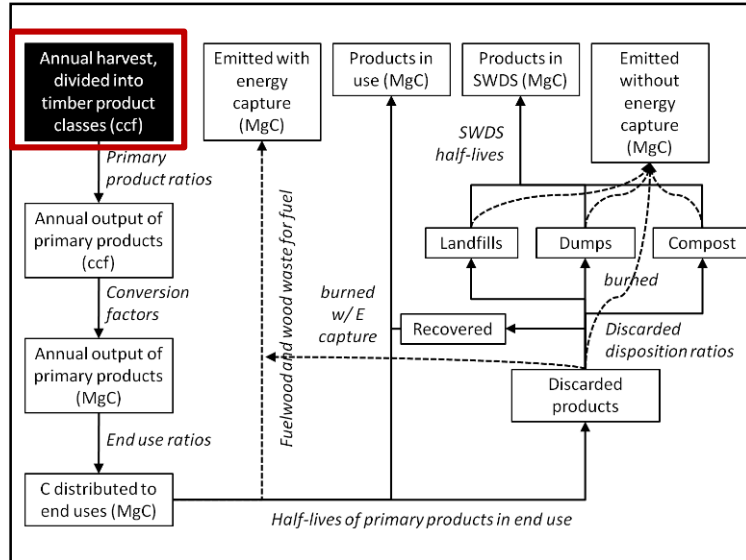
Classification of wood products



Calculations



Data Sources



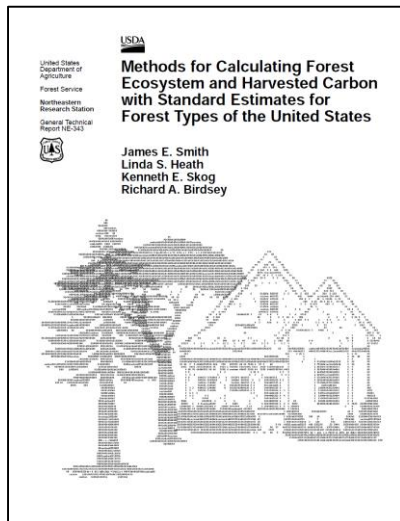
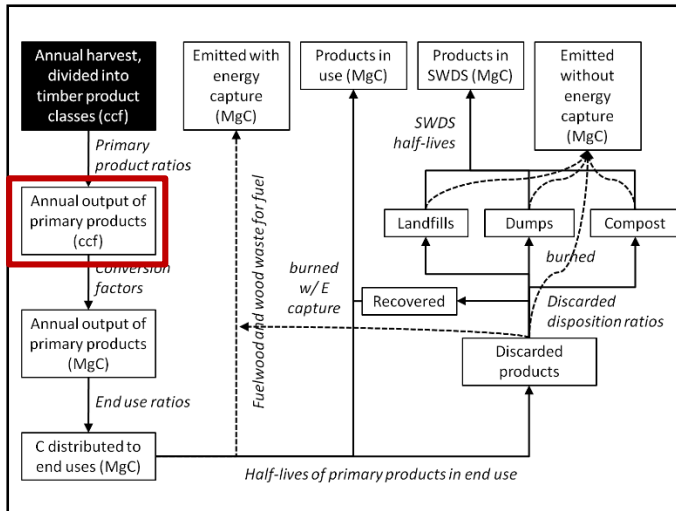
Harvest Data

- Archived harvest records
- Online cut-sold reports
- Timber product ratios (Skog & Nicholson 1998)
- Softwood v. Hardwood
- Timber product examples:
 - Sawtimber
 - Pulpwood
 - Fuelwood
 - Post and pole
 - “Non-saw”
 - Christmas trees

Data Sources

Primary products

- Market records
- Production reporting
- Primary product ratios (Smith et al. 2008)
- Examples:
 - Lumber
 - Pulp
 - Plywood/OSB/NS-panels
 - Mill residue
 - Poles
 - Fuelwood



Data Sources

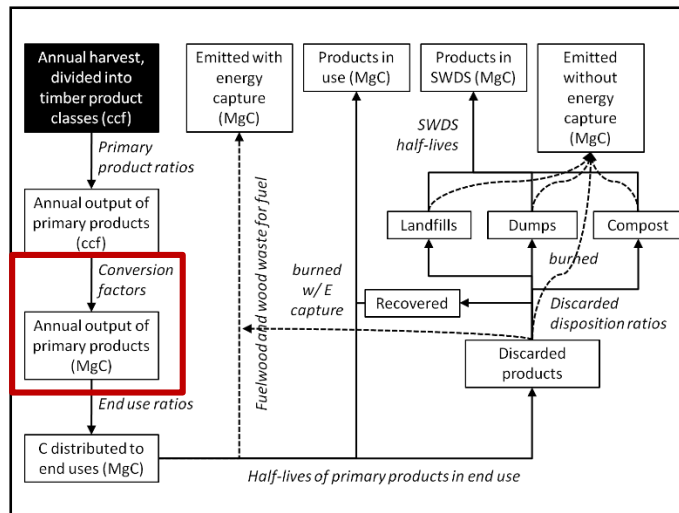


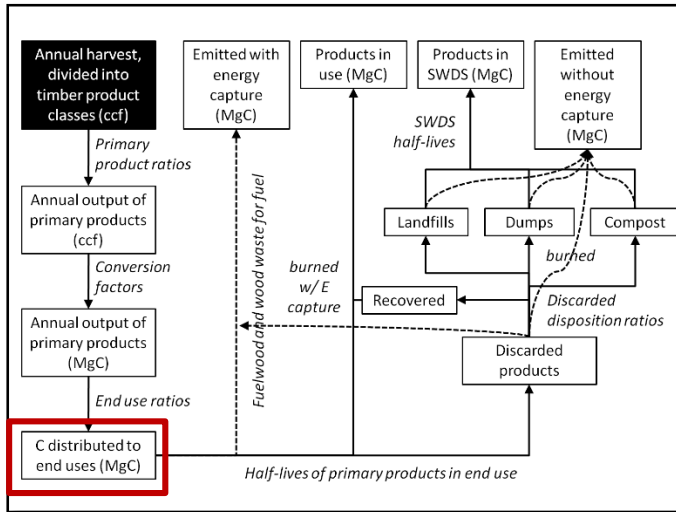
Table 2—Conversion factors used in this analysis.

Conversion	Units
2.2	ccf per mbf, timber harvest
1.75 to 2.56	ccf per mbf, timber products
33 to 42	lbs per cubic foot, primary products
2204.6	lbs per Mg
0.95 to 1.0	Mg wood fiber per Mg product
0.5	Mg carbon per dry Mg wood fiber
0.711 to 0.919	MgC per ccf, primary products

Convert Products to Carbon

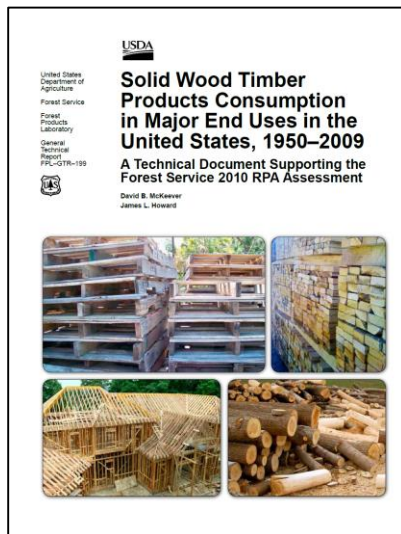
- Empirical conversions
- Industry “standards”
- Accepted conversions
- Regional and local conversions
- Smith et al. 2005, wood to C
- Examples:
 - IPCC
 - UN-FAO
 - USFS
 - Industry standards
 - LCA calculations
 - Etc., etc.

Data Sources



End use distribution

- Market records
- Production reporting
- End use ratios (S&N 1998; McKeever 2009)
- Examples:
 - Lumber, single family housing
 - Lumber, multifamily housing
 - Lumber, manufactured housing
 - Lumber, residential r and r
 - Lumber, nonresidential buildings
 - Lumber, other building



Data Sources

Decay functions

- Decay 1: End use → SWDS
- Decay 2: SWDS → Emissions
- Decay functions:
 - Empirical estimates
 - IPCC/EPA estimates
 - Area specific information

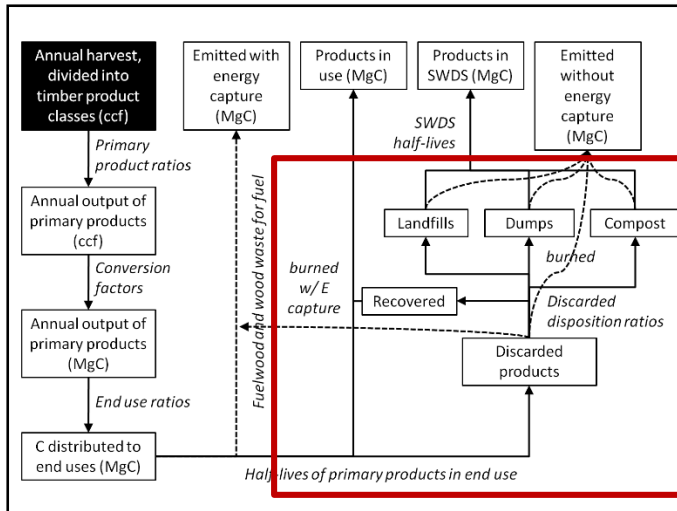


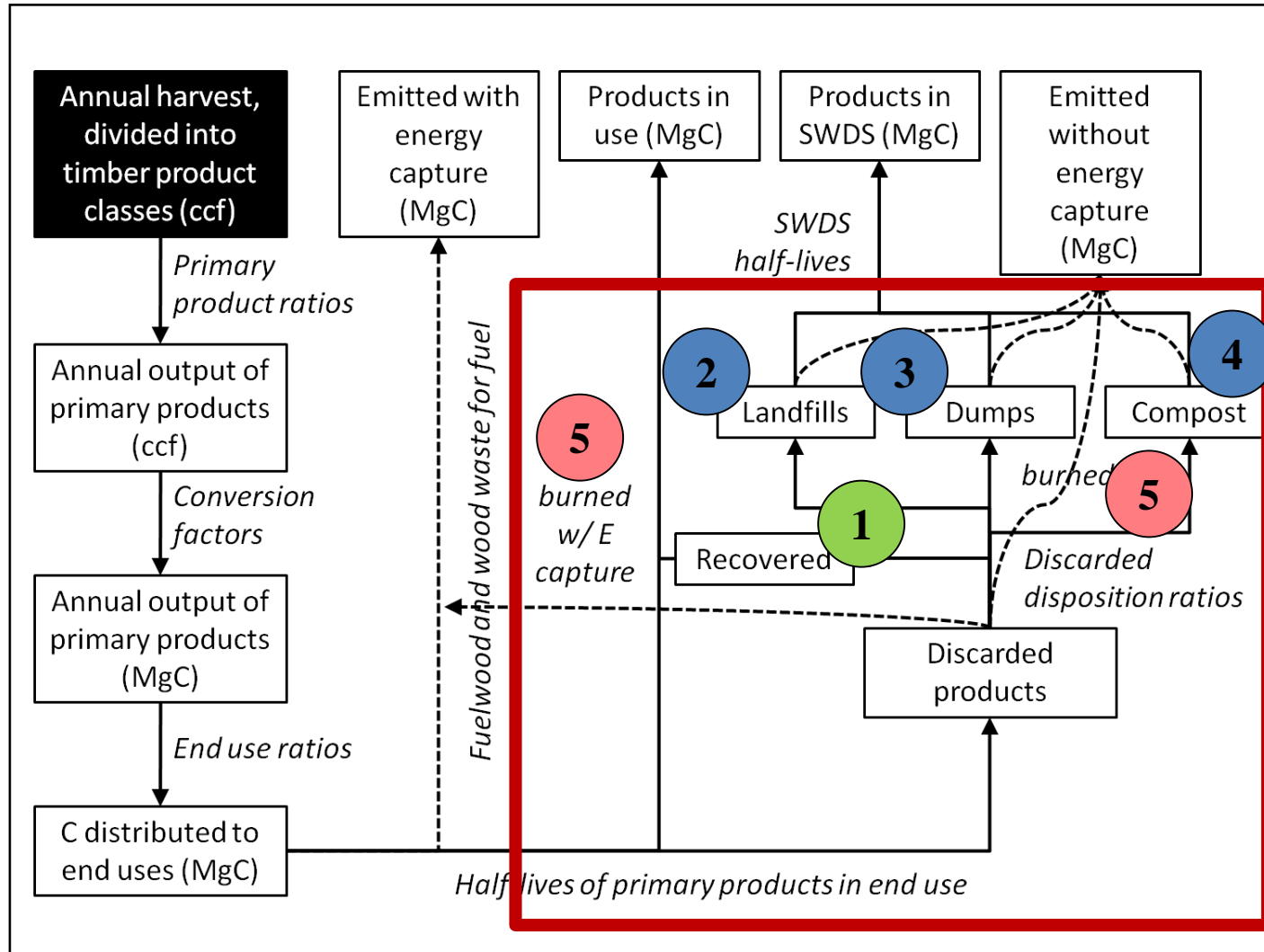
Table 4. — Initial estimates of half-life parameters for end uses (before validation/calibration).

Parameter	Definition	Value
HL_{H1}	Half-life of solidwood in single-family housing 1920 and before	75 years
HL_{H2}	Half-life of solidwood in single-family housing – 1921 to 1939 (years) ^a	80 years
F_H	Increase in half-life for each 20 year period after 1921 to 1939 (years)	5 years
F_{MF}	Ratio of half-life for solidwood in multifamily housing to half-life in single family housing	0.625
F_{AR}	Ratio of half-life for solidwood in alterations and repair of housing to half-life for single-family housing	0.3215
HL_{OTH}	Half-life for solidwood in all other end uses (years) ^b	30 years
HL_P	Half-life for paper in all end uses (years) ^b	2 years

^aU.S. housing half-life: Winistorfer et al. 2005; Athena Institute 2004.

^bOther solidwood and paper half-life: IPCC 2006b.

Calculations



Uncertainty Analysis

- Identify sources of uncertainty
- Set distributions
- Monte Carlo Simulation
- Quantify effects of uncertainty on outputs

The model(s)

[Home](#) [About](#) [Advanced](#) [Contact](#)

Harvested Wood Products

Configure a simulation.

Download an Excel macro-enabled workbook that will help create the input data files [here](#). Use the HWP Ribbon to export data in the correct format for this tool or to add a new year. Do NOT change the basic format of any of the worksheets.

Steps:

1 Upload yearly harvest data

No file chosen

2 Upload yearly timber product ratios

No file chosen

3 Upload yearly primary product ratios or choose region for default ratios

See a map of the regions [here](#).

or No file chosen

4 Upload distribution parameters (optional and rarely used)

No file chosen

5 Upload ratios for burned with energy capture (optional and rarely used)

No file chosen

6 Enter number of iterations

Any number larger than 1 will result in Monte Carlo simulation and the only output will be a table of confidence intervals around carbon storage for each year.

Address to send email when done with Monte Carlo:

7 Run the model

<http://maps.gis.usu.edu/HWP/>

Next steps

Start

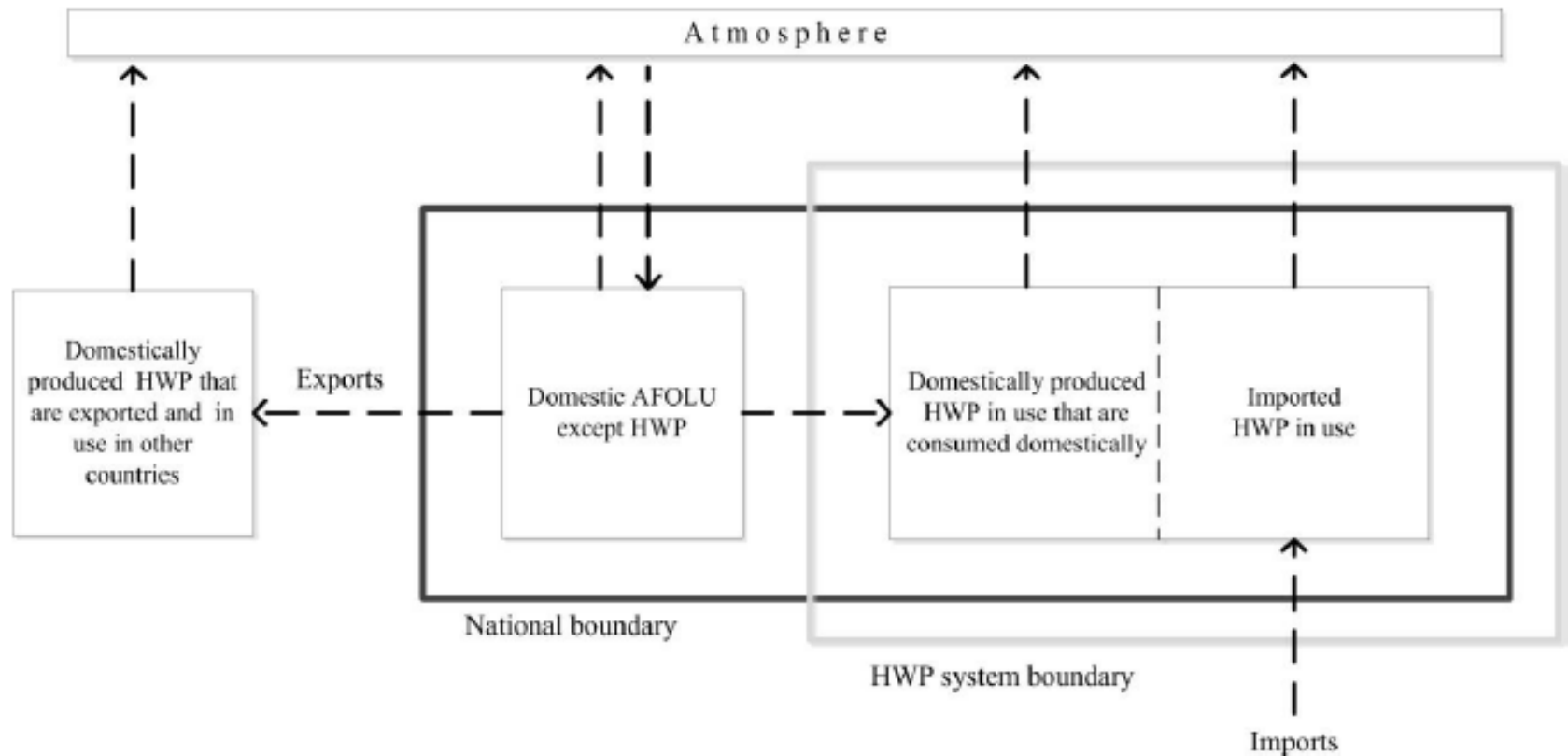
Thank you

Grant Domke: grant.m.domke@usda.gov

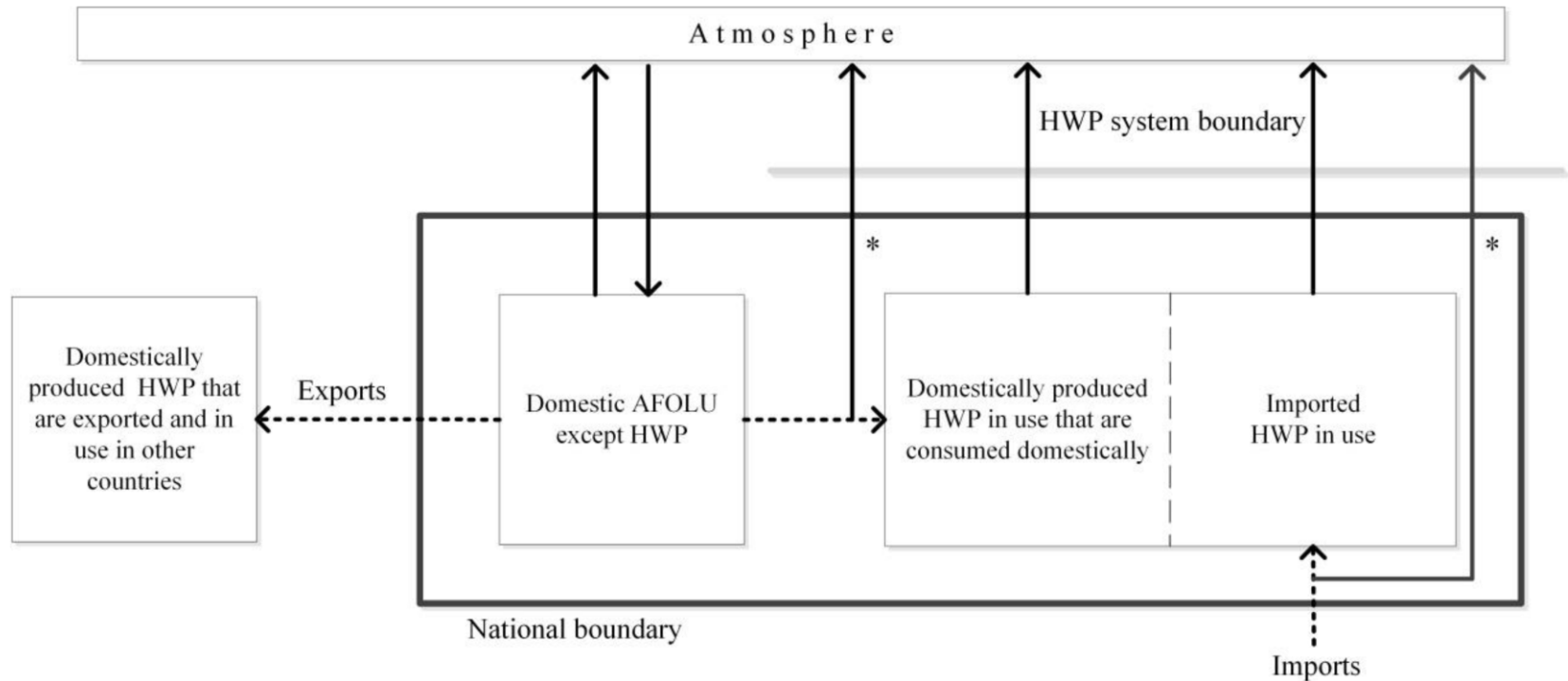
FIA program: www.fia.fs.fed.us

FIA carbon: <http://www.fia.fs.fed.us/forestcarbon/>

Stock change



Atmospheric flow



Timber Products vs. Primary Products

Timber Products:

Categories recorded at time of timber sale or harvest, may not closely correspond to primary products manufactured.

Examples: sawtimber, pulpwood, fuelwood, non-saw, misc-convertible products.

Primary Products:

Categories of 1st products manufactured from the timber, includes mill residue uses.

Examples: lumber, plywood, woodpulp, non-structural panels.

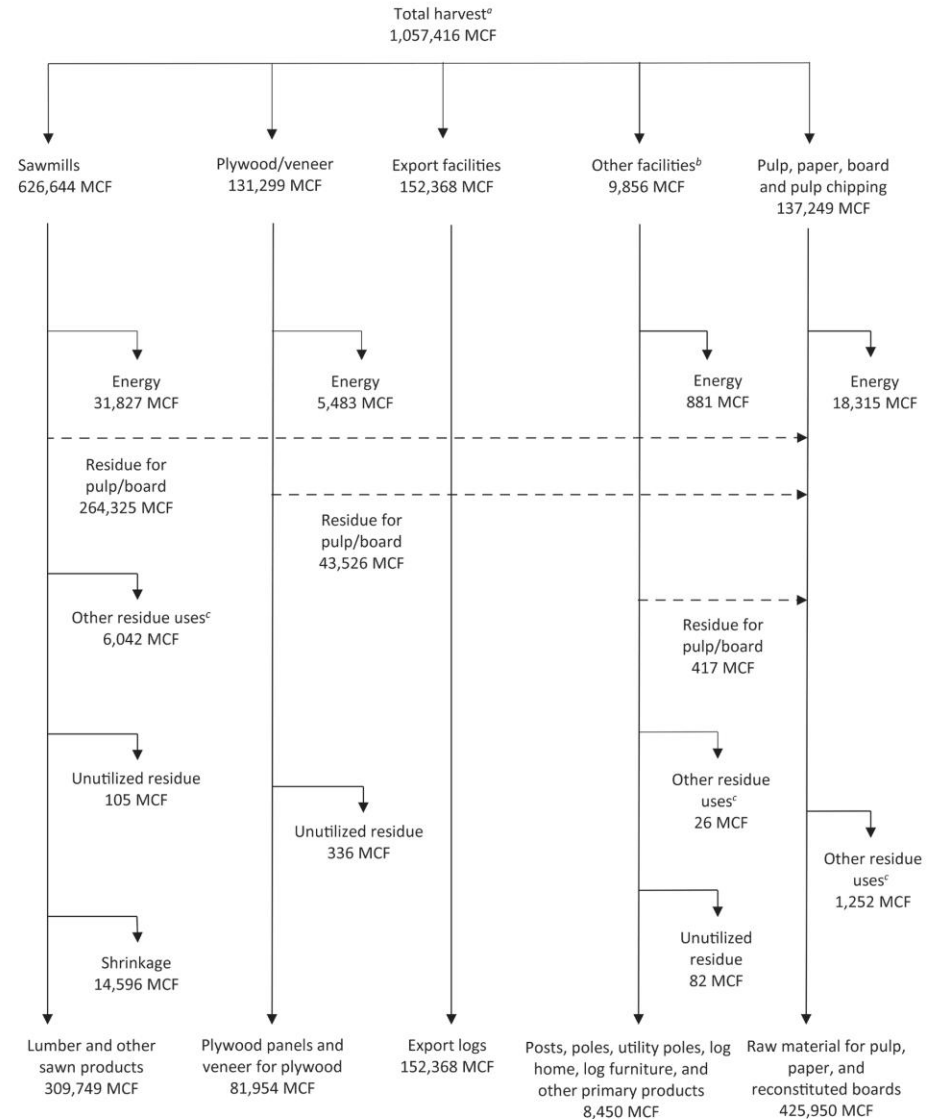
Timber Product Ratios

- The model has 40 timber product classes, 20 classes each for softwood and hardwood
- Annual time series; ratios sum to 1.00
- Examples of timber product classes include:
 - Hardwood sawtimber, softwood sawtimber, softwood poles, hardwood poles, hardwood pulpwood, softwood pulpwood, mine props, ties, float logs, miscellaneous convertible

Oregon Timber Harvest and Use

1,057 MMCF of wood fiber

- 60% to sawmills
- 14% to log exports
- 13% to pulp mills
- 12% to veneer mills
- 82% of mill residue used for pulp & particleboard
- 15% of mill residue used for energy
- 0.5 MMCF (0.1%) not used

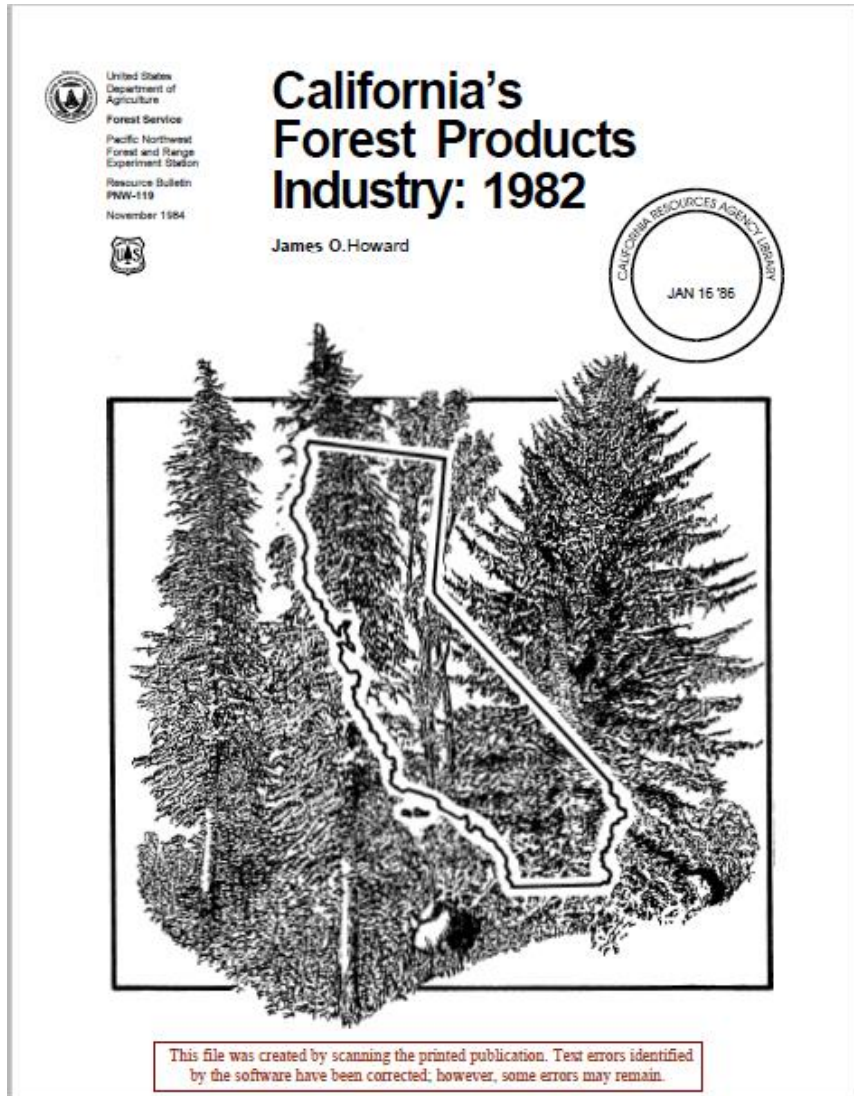


^a Harvest volume does not include bark.

^b Other facilities include producers of posts, poles, utility poles, log homes, log furniture, energy, energy products, and other products.

^c Other uses include landscape, mulch, and animal bedding.

Timber Product Ratios



All Industries, California

Table 8—Log consumption by mills, by species, resource area, and industry, California, 1982

(THOUSAND BOARD FEET, SCOTCHMAN LOG RULE)

RESOURCE AREA AND LOGS/1982	ALL SPECIES	DOUGLAS-FIR	REDWOOD	TRIE FIRS	SUGAR PINE	PONDEROSA PINE	LOCKEPOLE PINE	INCENSE CEDAR	OTHER SOFTWOODS	EXPORT
NORTH COAST:										
LUMBER	891,262	336,281	611,871	24,041	4,200	11,030	—	871	1,538	1,282
VENEER AND PLYWOOD	41,520	30,259	5,596	2,740	—	—	—	—	2,595	—
PULP AND BOARD	27,695	—	—	25,541	—	—	—	—	—	4,154
SHAKE AND SHINGLE	538	—	—	—	—	—	—	—	—	—
TOTAL	1,061,020	366,570	617,567	50,322	4,200	11,030	—	1,321	4,829	5,436
CENTRAL COAST:										
LUMBER	16,210	1,770	12,383	—	—	—	—	2,000	7	—
TOTAL	16,210	1,770	12,383	—	—	—	—	2,000	7	—
NORTHERN INTERIOR:										
LUMBER	512,915	95,201	—	85,356	95,915	237,675	2,562	33,294	490	200
VENEER AND PLYWOOD	40,837	13,784	—	75,344	482	2,088	—	—	—	—
TOTAL	606,552	109,085	—	160,600	97,378	240,563	3,555	33,294	490	200
SACRAMENTO:										
LUMBER	531,836	66,800	—	173,745	65,575	181,417	—	30,247	80	4,000
VENEER AND PLYWOOD 1/	23,223	3,910	—	18,862	13	550	—	—	—	—
TOTAL	555,059	70,710	—	192,607	65,588	181,966	32	30,247	80	4,000
SAN JOAQUIN:										
LUMBER	318,528	10,783	—	117,029	48,815	108,040	2,521	33,330	37	—
VENEER AND PLYWOOD 1/	—	—	—	—	—	—	—	—	—	—
TOTAL	318,528	10,783	—	117,029	48,815	108,040	2,521	33,330	37	—
EXPORT:										
LUMBER	—	—	—	—	—	—	—	—	—	—
VENEER AND PLYWOOD	2,370,777	531,271	524,324	405,171	178,504	516,385	5,114	66,912	2,130	6,452
PULP AND BOARD	158,390	47,360	5,596	81,571	475	3,271	—	—	2,895	—
SHAKE AND SHINGLE	27,695	—	—	—	—	—	—	—	—	—
EXPORT 2/	538	—	—	—	—	—	—	—	—	—
POST, POLE, AND PILING 2/	29,874	3,071	2,506	21,013	71	1,027	—	71	3,041	—
TOTAL	2,598,812	584,482	632,430	547,401	179,082	521,443	5,653	100,343	5,244	6,452

1/ Sacramentos and San Joaquin combined to avoid disclosure.
2/ All resource areas combined to avoid disclosure.

ALL AREAS:
LUMBER
VENEER AND PLYWOOD
PULP AND BOARD
SHAKE AND SHINGLE
EXPORT 2/
POST, POLE, AND PILING 2/

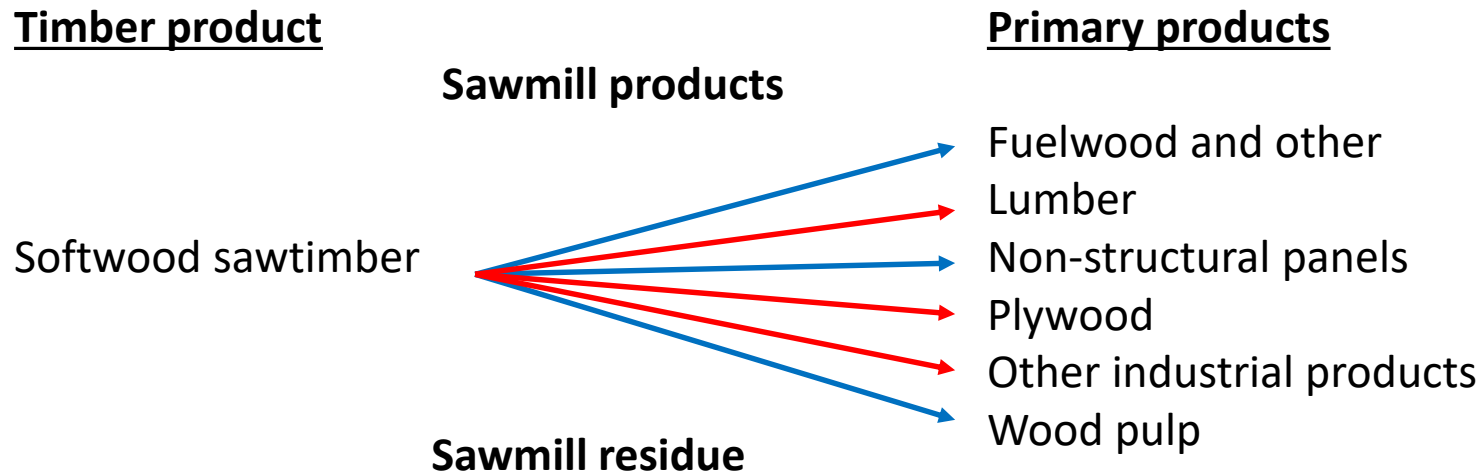
2,370,777
158,390
27,695
538
29,874
11,538

TOTAL

2,598,812

Primary Product Ratios

- Annual volumes of harvested timber products (e.g. softwood sawtimber) distributed to primary products
- The model has 64 primary product classes
- Examples of primary product classes include:
 - Softwood lumber, softwood poles, hardwood wood pulp, softwood wood pulp
- Example of a timber product distributed to primary products:



Oregon Mill Residue

About 4.8 million BDT of woody mill residue (excluding bark) generated annually.

About 0.1% not used.



Most used for pulp/paper or particleboard (>82%)

Less used for bioenergy and landscaping/mulch

Result of wood products industry operating in OR

Table 27—Production and disposition of wood residue by sawmills, by type of residue, use, resource area, and mill-size class, California, 1982

(TONS, DRY WEIGHT)

ALL TYPES OF RESIDUE

RESOURCE AREA AND
MILL-SIZE CLASS 1/

TOTAL

USED 2/

PULP

BOARD

FUEL

MISCELLANEOUS

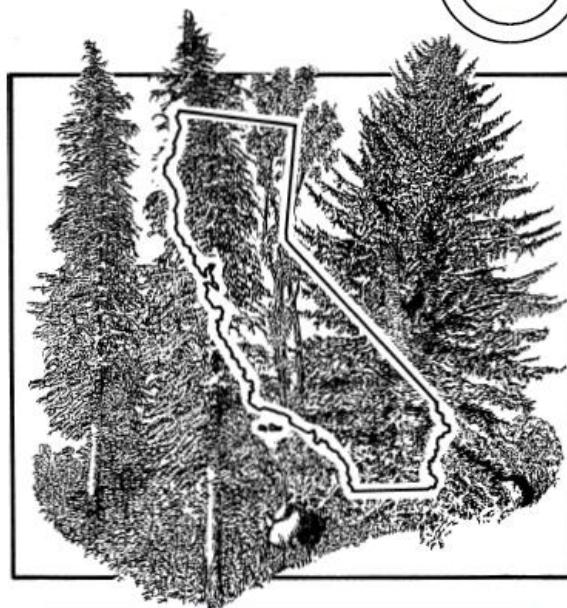
UNUSED



United States
Department of
Agriculture
Forest Service
Pacific Northwest
Forest and Range
Experiment Station
Resource Bulletin
RMW-119
November 1984

California's Forest Products Industry: 1982

James O. Howard



This file was created by scanning the printed publication. Text errors identified by the software have been corrected, however, some errors may remain.

C	35,931	30,981	5,831	1,766	3,045	816	259
B	555,340	549,484	177,648	47,517	256,106	68,213	5,856
A	2,384,407	2,350,754	876,007	248,884	1,017,881	107,982	33,653
TOTAL	2,980,361	2,935,643	1,060,049	398,167	1,292,742	184,685	44,718

See footnotes at the end of table.

HWP distribution examples

- **Timber product:**

Softwood sawtimber

- **Primary products:**

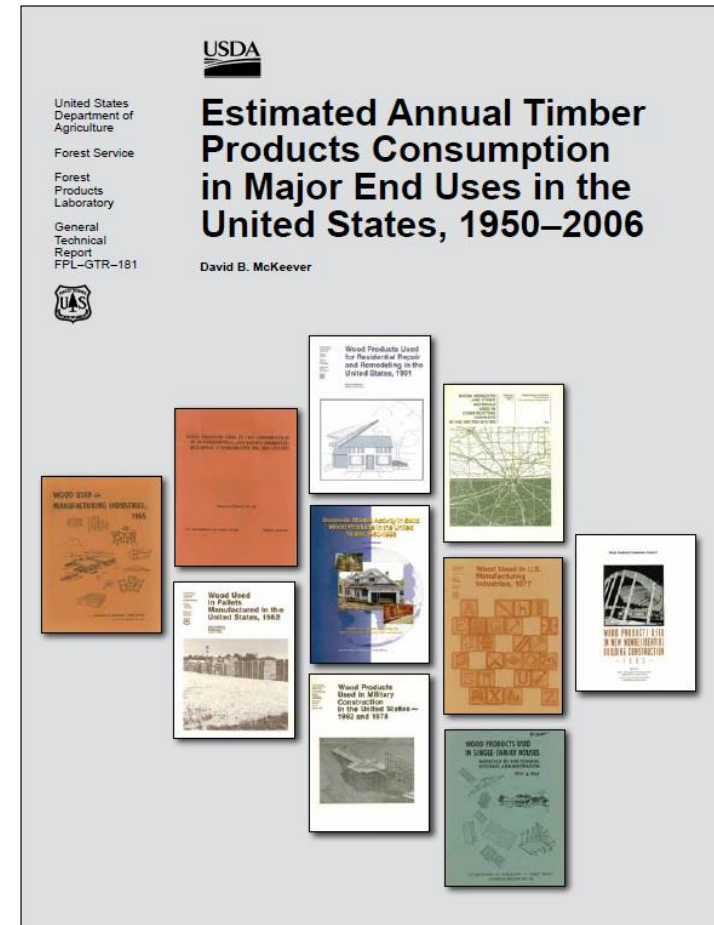
Softwood lumber, softwood plywood, mill residue pulp, mill residue fuel, mill residue non-structural panel, etc.

- **End uses:**

New residential construction (single, multi family, mobile homes) residential upkeep and improvement, new non-residential construction, manufacturing (household furniture, other furniture, other products), shipping, other uses

End Use Ratios

- McKeever, David B. 2009. FPL-GTR-181
- 224 primary product end uses:
 - 47 each for HW and SW sawtimber
 - 47 each for HW and SW pulpwood
 - 36 for all other primary products



HWP Data Sources

- Annual Harvest data (several sources)
- Timber & Primary product ratios (from OR mill studies):
 - **2017, 2013, 2008, 2003**, 1998, 1994, 1992, 1988, 1985, 1982, 1976, 1972, 1968
- Wood to carbon estimates (Smith et al. GTR-343)
- Half-life data (Skog 2008)
- End use ratios (McKeever 2009)
- Fuelwood and wood waste emitted with energy capture, discarded products to landfills, dumps, compost (Skog 2008)

* **Bold font** = user created data; plain font = examples of data and parameters hard wired in the current HWP model